3. 1. 2 Accelerating Structure and Beam Transport

3. 1. 2. 1 LEBT

A schematic drawing of the joint project LEBT is shown in FIG 3.1.2.1.1. Only the induction cavity is under development. The other parts in this figure are used to operate the ion source and the 30mA-RFQ. The LEBT are composed of two solenoid magnets (SMAG's), a chamber for beam monitors (a movable Faraday cup and two sets of double slit scanner type emittance monitors) and a 500 L/s turbo molecular vacuum pump system, an induction cavity for a energy modulation type pre-chopper [1] and a gate valve, which is essential for the maintenance of the ion source without any degradation of the RFQ condition. Except for the pre-chopper cavity, the conventional focusing elements (two SMAG's) as the RFQ injector was adopted. However, the total length is minimized by using the short strong SMAG's in order to minimize the emittance growth due to the lens aberration and so on [2].

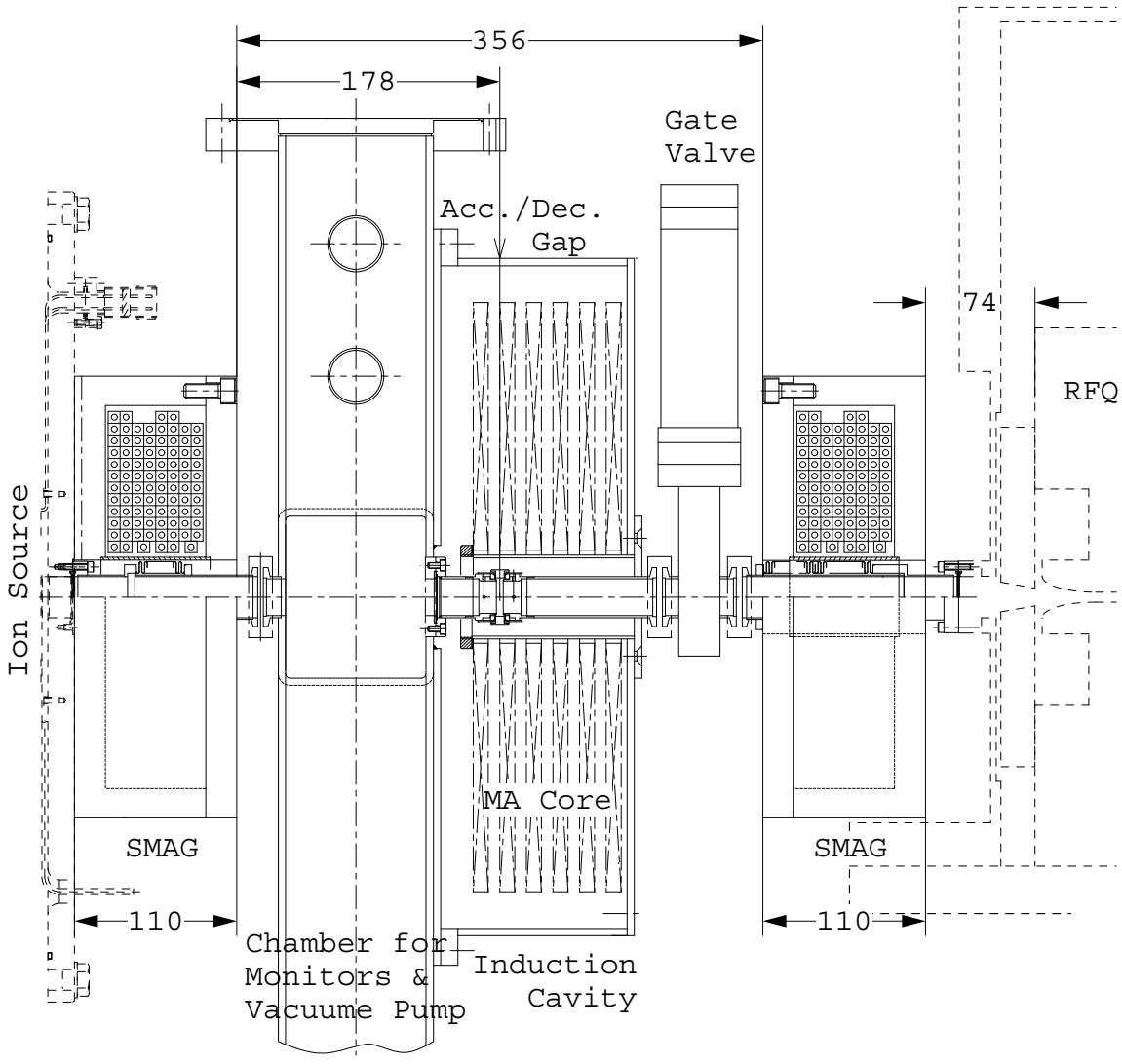

FIG 3.1.2.1.1 Schematic drawing of LEBT.

The principle of the pre-chopper is explained in FIG 3.1.2.1.2 and 3. As shown in

FIG 3.1.2.1.2, which is the simulation results with BEAMPATH on the 30mA-RFQ for a 0 mA injected beam, the injected beam less than a threshold value (43 keV for the 30mA-RFQ and about 42 keV for the 50mA-RFQ) cannot transmit through the RFQ. Therefore, the injection beam, whose energy is modulated as the green line of FIG 3.1.2.1.3 can be chopped by the RFQ. The beam with the energy less than the blue line is lost in the RFQ. The ideal (neglecting rise/fall time) gap voltage of the induction cavity is shown in FIG 3.1.2.3. The pre-chopper parameters of the typical operation are shown in Table 3.1.2.1.1.
The pre-chopper system with a design rise/fall time less than 50ns is underdevelopment.

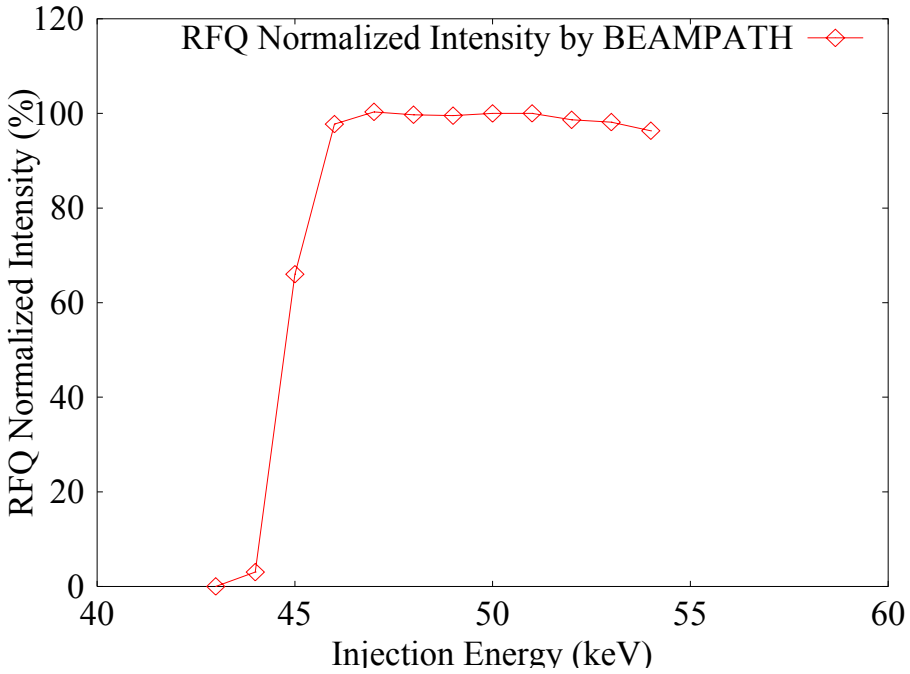

FIG 3.1.2.1.2 Relationship between injection beam energy and 30mA-RFQ transmission simulated with BEAMPATH.

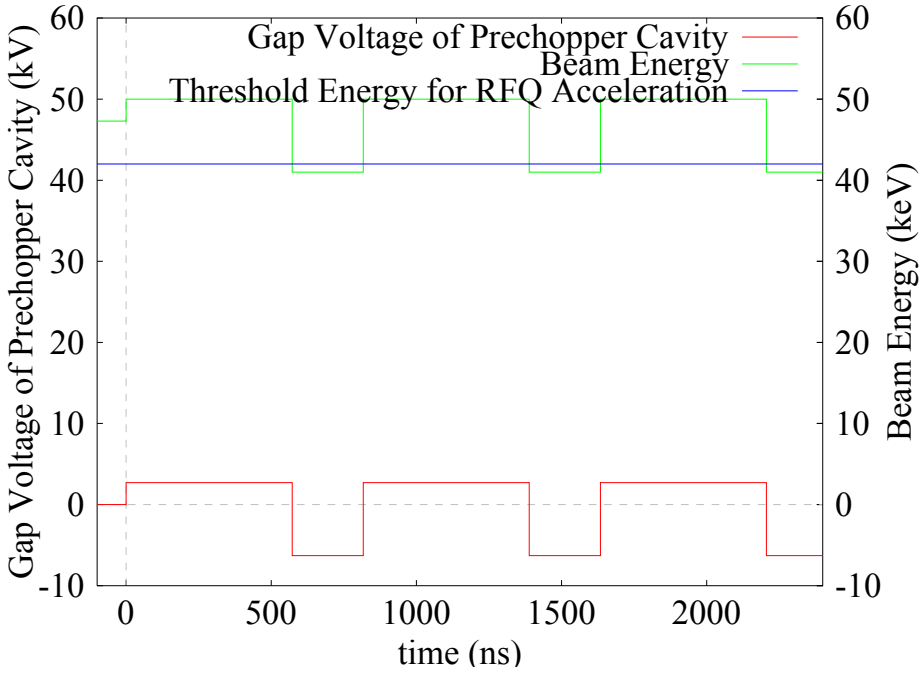

FIG 3.1.2.1.3 Principle of energy modulation type pre-chopper.

Table 3.1.2.1 Pre-chopper parameters for a typical operation (70% chopping).

Rise/fall time	Injected beam energy	Vacc	dt_Vacc	Vdec	dt_Vdec
<50 ns	47.3 keV	+2.7 kV	515 ns	−6.3 kV	221 ns

*Beam energy ejected from LEBT=50 keV or 41 keV,
*Vacc*dt_Vacc= Vdec*dt_Vdec to avoid core saturation.

References

[1] W. Chou et al, Proc. 1999 Part. Accel. Conf., 565(1999).
[2] S. Fujimura, A. Ueno and Y. Yamazaki, Proc. 9th Symp. on Accel. Sci. and Tech., JAERI-Conf 95-021, 254, (1993).